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Liu et al.

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(54) **EMERGENCY EXIT INDICATOR INCORPORATING LED UNIT**

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(51) **Int. Cl.**
F21S 4/00 (2006.01)

(52) **U.S. Cl.** **362/249.02**; 362/812

(58) **Field of Classification Search** 362/602, 362/612, 616, 147, 183, 249.02, 812
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,136,083	A *	6/1964	Guth, Jr.	362/812
5,018,290	A *	5/1991	Kozek et al.	362/812
5,768,814	A *	6/1998	Kozek et al.	362/183
8,024,880	B2 *	9/2011	Kuan et al.	362/812

* cited by examiner

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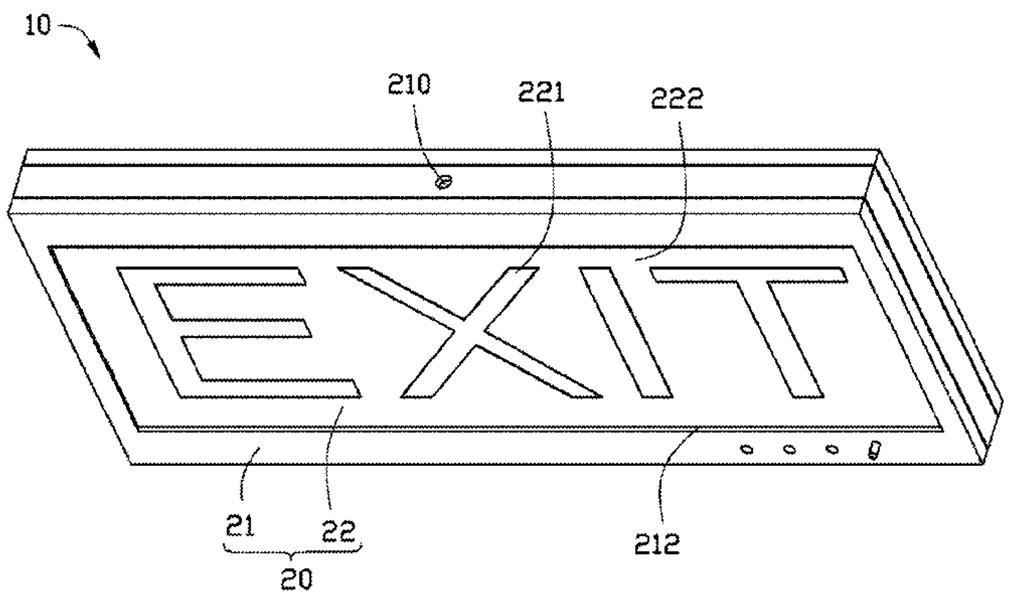
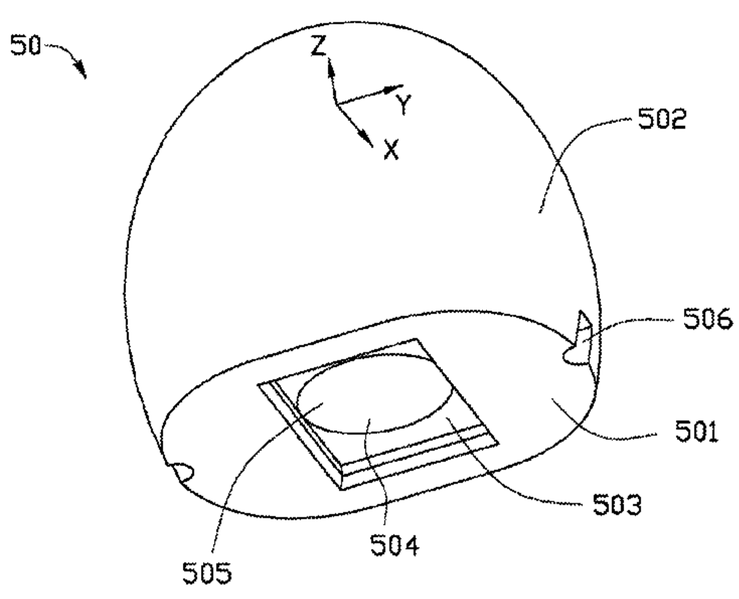
(57) **ABSTRACT**

An emergency exit indicator includes a flat housing and a light source received in the housing. The housing has a length greater than a width thereof. The housing includes a panel provided with a sign thereon to indicate emergency exit. The light source includes a plurality of LEDs each being covered by a lens. Light of the LED goes through the lens and is then illuminated on the sign to cause the sign to be visible. The lens has two opposite sides along a lengthwise direction of the housing longer than other two opposite sides along a widthwise direction of the housing, such that the light through the lens along the widthwise direction of the housing is converged in a narrower manner than the light through the lens along the lengthwise direction of the housing.

19 Claims, 10 Drawing Sheets





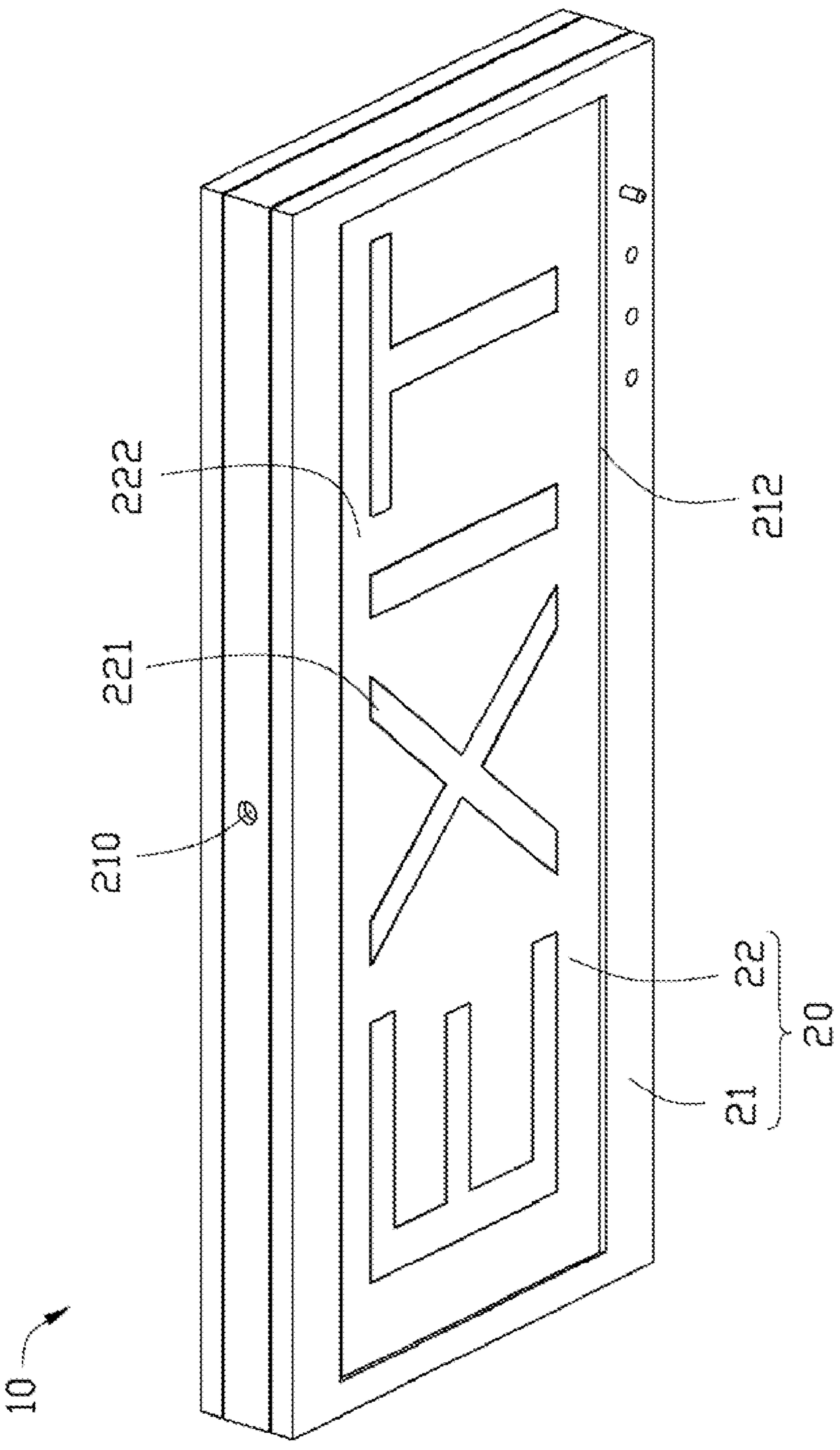


FIG. 1

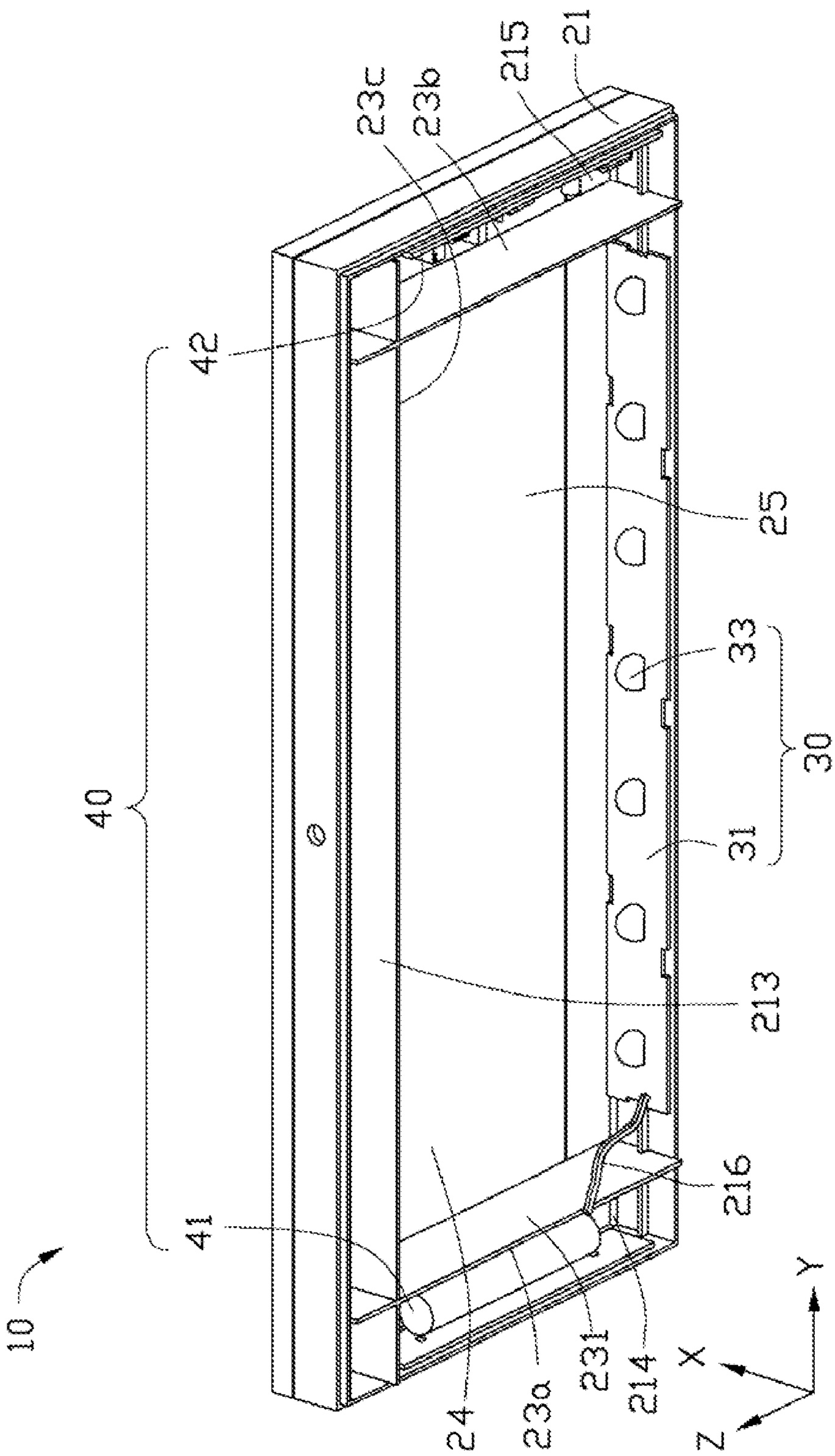


FIG. 2

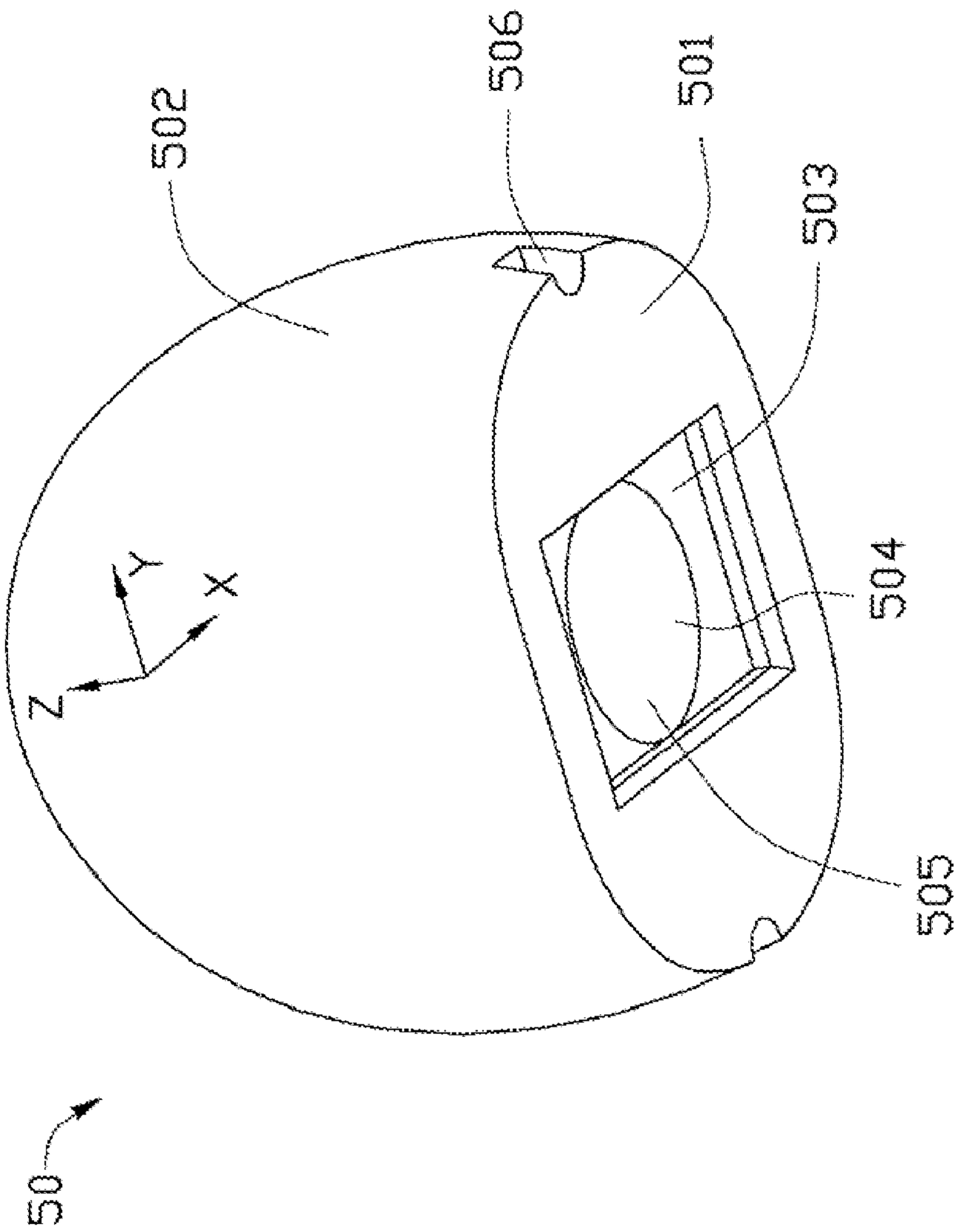


FIG. 3

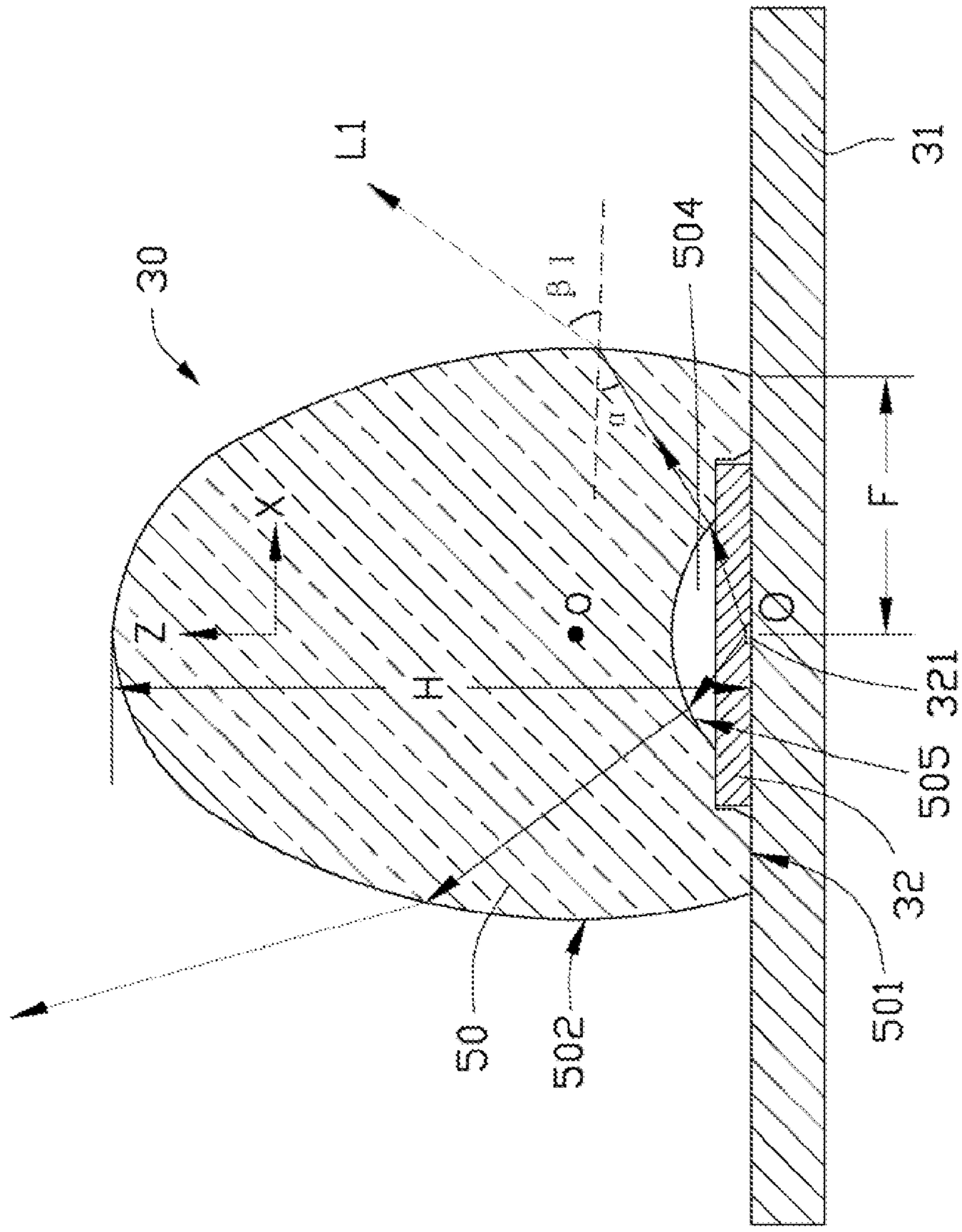


FIG. 4

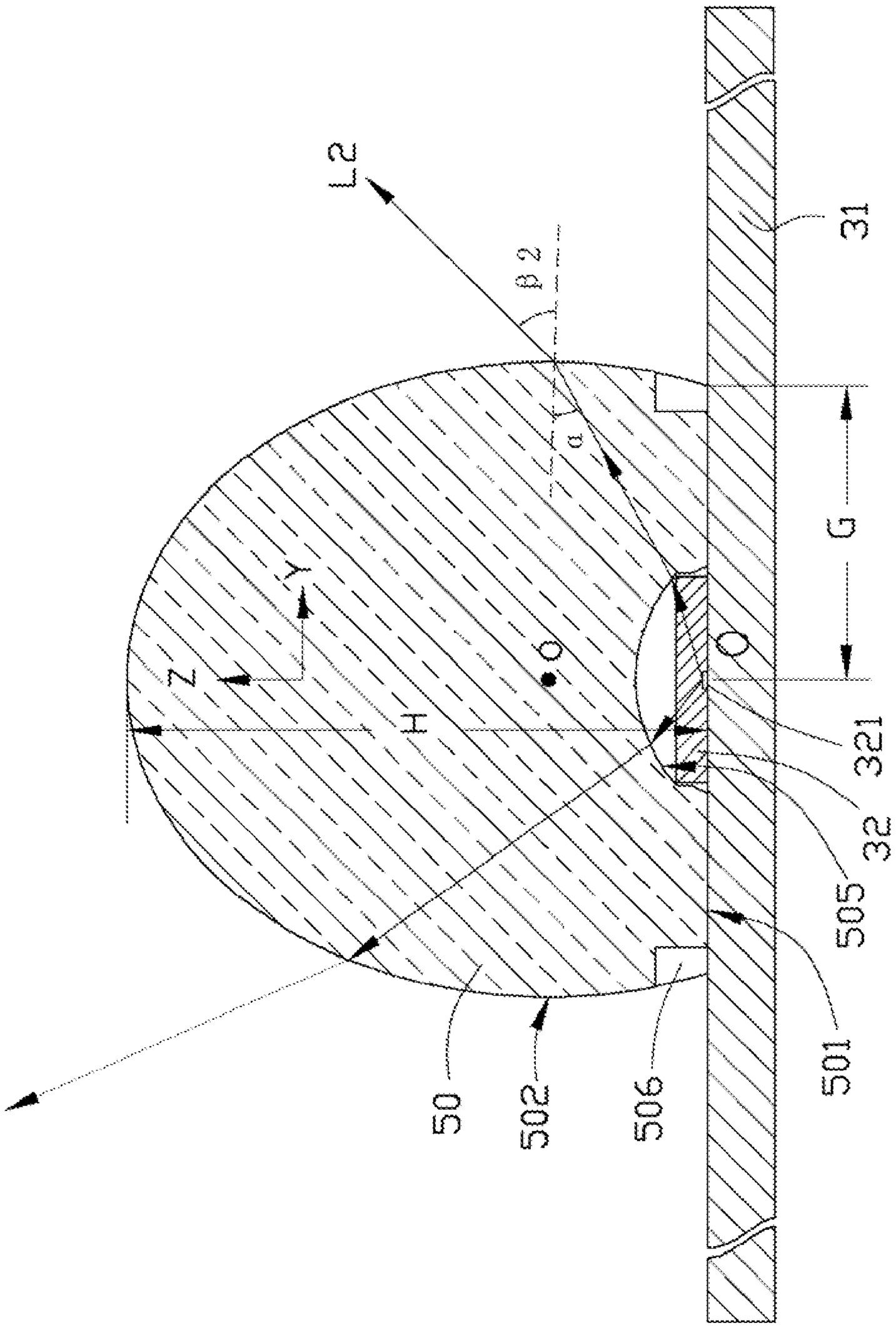


FIG. 5

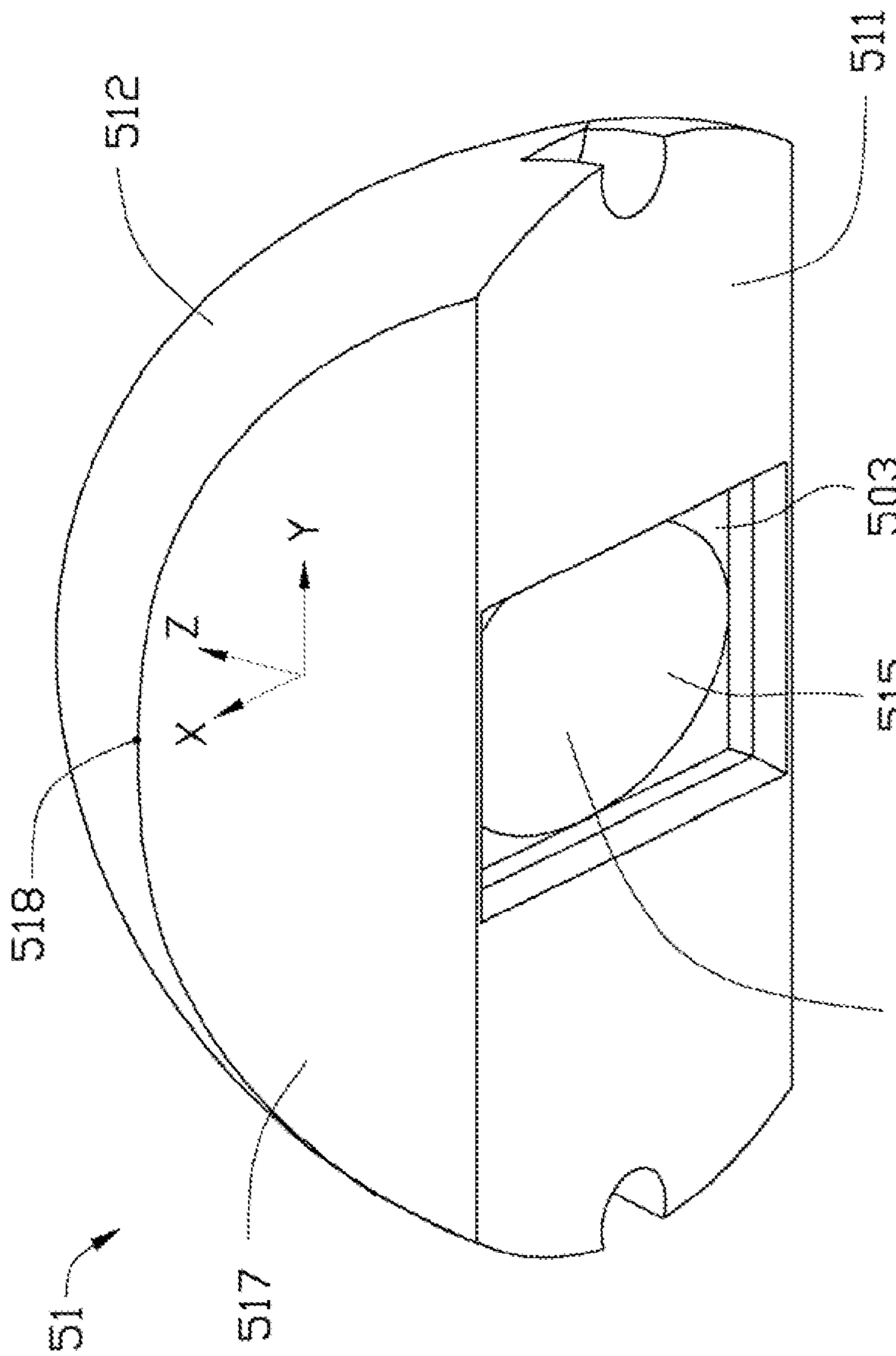


FIG. 6

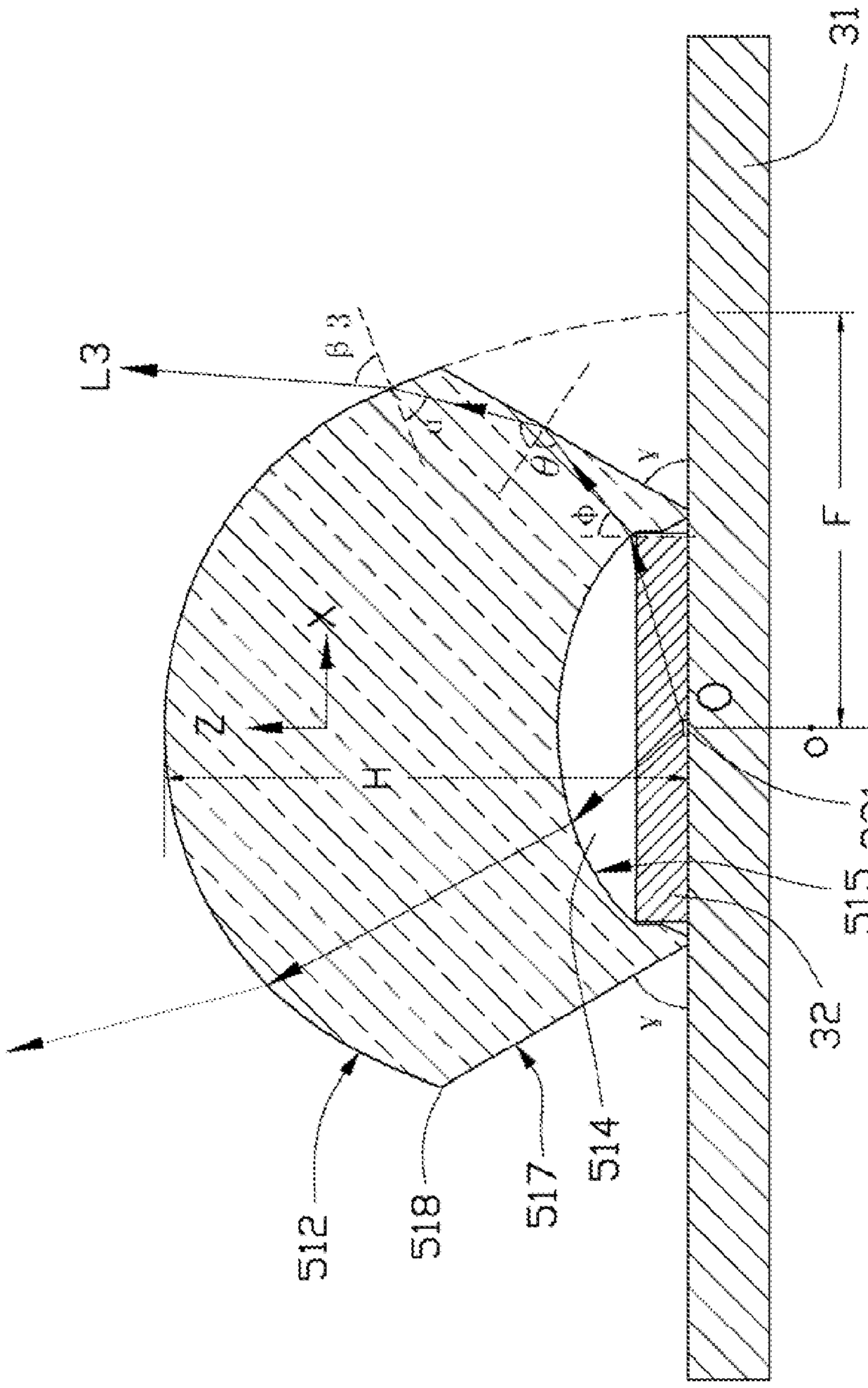


FIG. 7

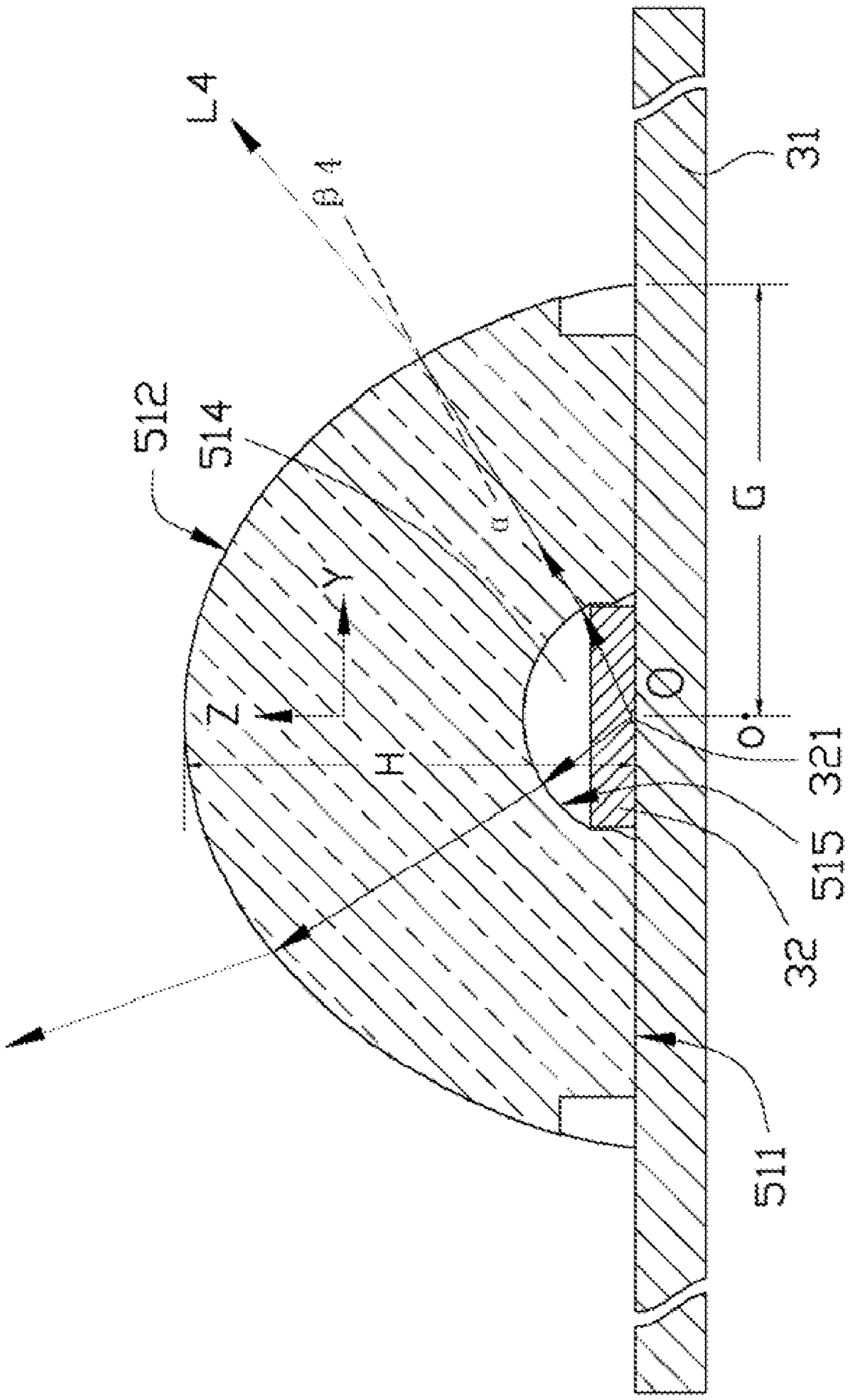


FIG. 8

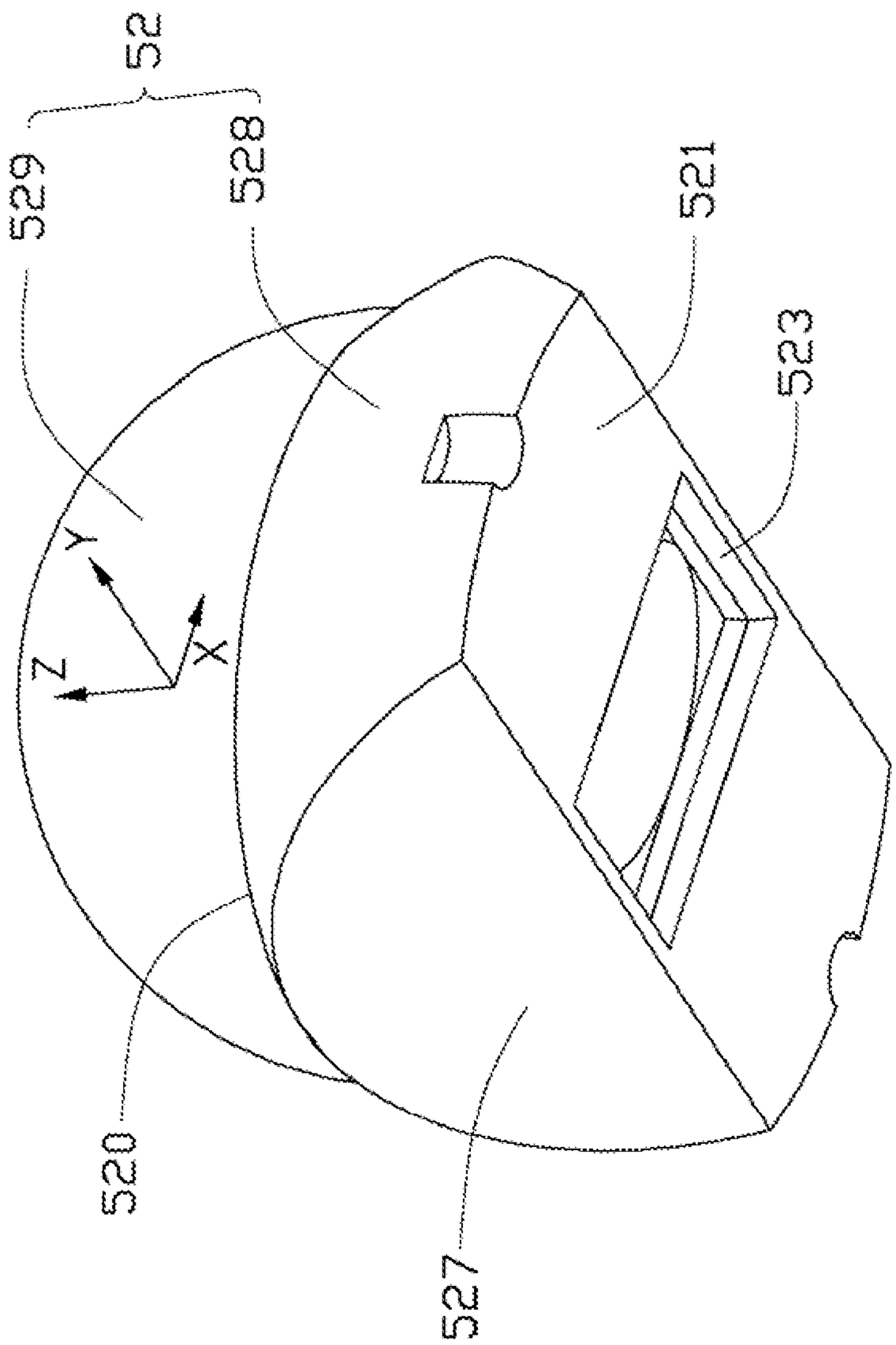


FIG. 9

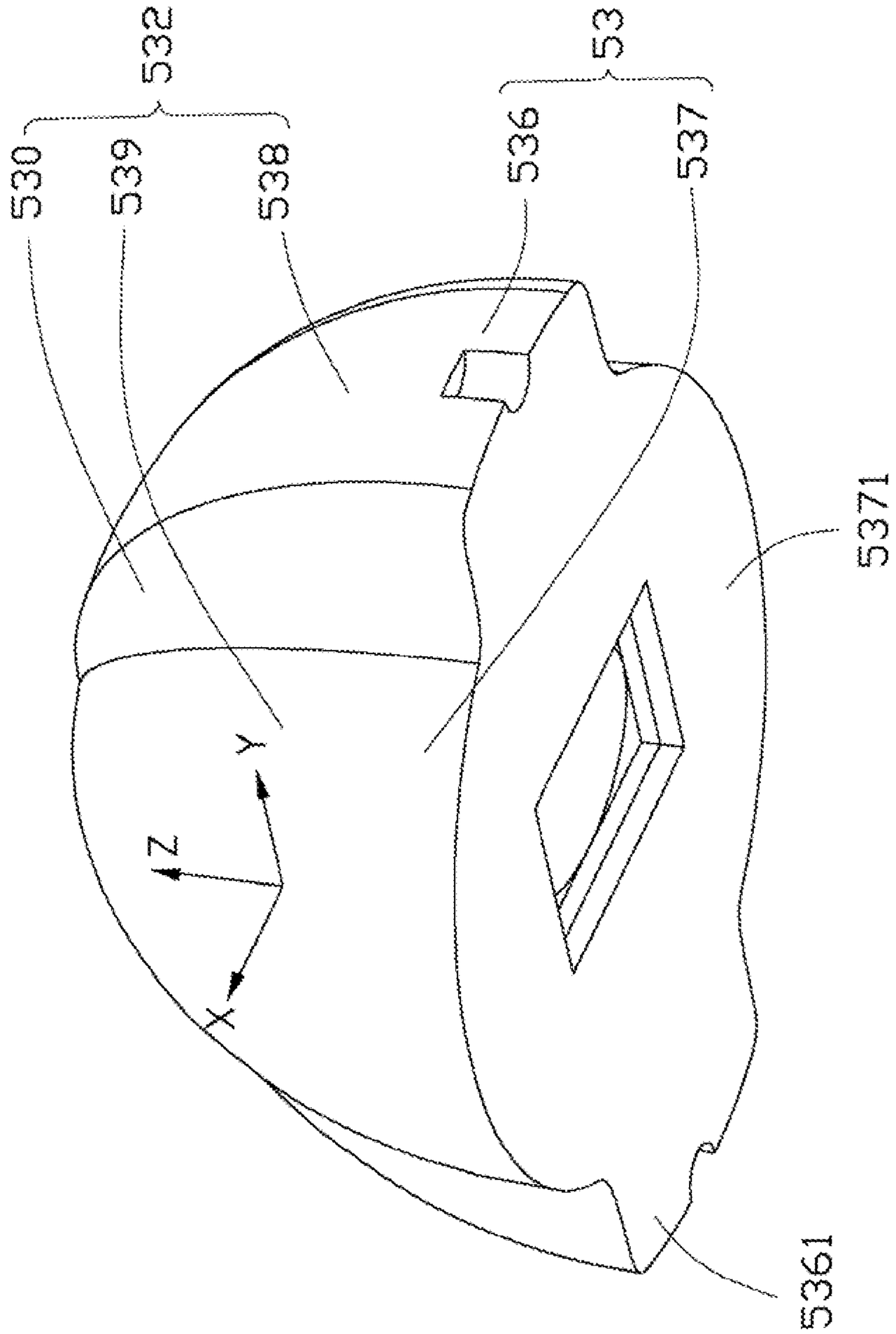


FIG. 10

EMERGENCY EXIT INDICATOR INCORPORATING LED UNIT

BACKGROUND

1. Technical Field

The disclosure generally relates to a lighting apparatus, and particularly to an emergency exit indicator incorporating an LED unit.

2. Description of Related Art

Provision of emergency exits in commercial buildings is required by law. The signs that mark emergency exits are typically used in the case of power failures (blackout), fires, and other emergency situations. An emergency exit indicator is required as a standard equipment for public facilities, such as shopping malls or airplanes. Numerous different types of emergency exit indicators exist in the art including those that use lights to guide people in the direction of an emergency exit door. When the condition requires, the emergency exit indicator is able to indicate the location of an emergency escape exit for people so as to assist people evacuation.

LEDs have been increasingly used in a variety of occasions, such as residential, traffic, commercial, and industrial occasions due to their high light-emitting efficiency. Related emergency exit indicators generally use multiple LEDs arranged along a side of a cover thereof so that the light emitting from the LEDs could radiate through symbols, letters or patterns on the cover to make the symbols, letters or patterns shine or glitter. However, the light emitting from the LEDs is highly directive that the symbols, letters or patterns on the cover cannot be uniformly illuminated, and the light-utilizing efficiency of the indicating lamp is accordingly limited.

What is needed, therefore, is an emergency exit indicator incorporating an LED unit which can overcome the limitations described above.

BRIEF DESCRIPTION OF THE DRAWINGS

Many aspects of the disclosure can be better understood with reference to the following drawings. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the disclosure. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

FIG. **1** is an isometric view of an emergency exit indicator according to a first embodiment of the disclosure.

FIG. **2** is similar to FIG. **1**, but with a front panel of the emergency exit indicator being removed.

FIG. **3** is an isometric view of a lens for a light source of the emergency exit indicator of FIG. **2**.

FIG. **4** is a cross-section of the light source with the lens of FIG. **3** along a plane defined by the Z axis and the X axis.

FIG. **5** is a cross-section of the light source with the lens of FIG. **3** along a plane defined by the Z axis and the Y axis.

FIG. **6** is an isometric view of a lens for a light source of the emergency exit indicator according to a second embodiment.

FIG. **7** is a cross-section of the light source with the lens of FIG. **6** along a plane defined by the Z axis and X axis.

FIG. **8** is a cross-section of the light source with the lens of FIG. **6** along a plane defined by the Z axis and the Y axis.

FIG. **9** is an isometric view of a lens for a light source of the emergency exit indicator according to a third embodiment.

FIG. **10** is an isometric view of a lens for a light source of the emergency exit indicator according to a fourth embodiment.

DETAILED DESCRIPTION

Referring to FIGS. **1** and **2**, an emergency exit indicator **10** according to a first embodiment of the disclosure is illustrated. The emergency exit indicator **10** includes a housing **20**, a light source **30**, and an electrical module **40**. The electrical module **40** and the light source **30** are received in the housing **20**.

The housing **20** is flat and rectangular. The housing **20** includes a frame **21** and a front panel **22** coupled to the frame **21**. The panel **22** is located at a front side of the housing **20**. A back plate **25** is mounted at a rear side of the housing **20**. The front panel **22** is provided with a sign **221** thereon, wherein the sign **221** may be symbols, letters or patterns that can be used to mark emergency exits. People can see the sign **221** when the sign **221** is illuminated by the light source **30**. Other portions of the front panel **22** surrounding the sign **221** is light non-penetrable to form a non-display area **222**.

The light source **30** is located at a bottom side in the housing **20**. Three spacing plates **23***a*, **23***b*, **23***c* are provided in the housing **20** and arranged adjacent to three other sides (i.e., left side, right side and top side), respectively. An elongated space **214** is defined between the frame **21** and the left-side spacing plate **23***a* for receiving a rechargeable battery **41** of the electrical module **40** therein. An elongated space **215** is defined between the frame **21** and the right-side spacing plate **23***b* for receiving a circuit board **42** of the electrical module **40** therein. An elongated space **213** is defined between the frame **21** and the top-side spacing plate **23***c* for receiving power lines (not shown) therein, wherein the power lines extend out of the housing **20** through a wire hole **210** defined at the top side of the housing **20** for electrically connecting the circuit board **42** with an external alternating current (AC) power source (not shown).

The light source **30** includes a substrate **31** and a plurality of SMD LED units **33** mounted on the substrate **31**. The LED units **33** are evenly arranged on the substrate **31** and spaced from each other. A light distribution space **24** is defined in the housing **20** and surrounded by the substrate **31** and the three spacing plates **23***a*, **23***b*, **23***c*. The light emitting from the LED units **33** of the light source **30** enters and is mixed in the light distribution space **24** which is located above the light source **30**. After the light is mixed in the light distribution space **24**, the light then illuminates uniformly on the sign **221** of the front panel **22** to cause the sign **221** to be visible noticeably. In order to more evenly reflect the light in the light distribution space **24** towards the sign **221**, an inner surface of each spacing plate **23***a* (**23***b*, **23***c*), an inner surface of the non-display area **222** of the front panel **22** and an inner surface of the back plate **25** may be coated with a light reflecting material to form a light reflecting surface **231**.

The rechargeable battery **41** and the circuit board **42** of the electrical module **40** are electrically connected with the substrate **31** of the light source **30** by electrical wires **216**. Several circuits are formed on the circuit board **42**. Such circuits may include AC to direct current (DC) conversion circuit, battery charging circuit, and control circuit. During operation, the external AC power source is electrically connected with the circuit board **42** by the power lines. The AC to DC conversion circuit on the circuit board **42** converts the AC power provided by the external AC power source into DC power. When the external AC power source is supplied normally, the DC power converted from the external AC power source is supplied to

the light source **30** and the rechargeable battery **41**. As a result, the light source **30** is turned on to emit light, and at the same time, the rechargeable battery **41** is charged via charging control by the battery charging circuit on the circuit board **42**.

When the external AC power source supply is interrupted, the external AC power source can no longer supply power to the light source **30**. At this time, the control circuit on the circuit board **42** controls the light source **30** to automatically change to a state in which the rechargeable battery **41** begins to supply DC current to the light source **30** to cause the light source **30** to emit light, such that the light source **30** can emit light in an uninterrupted manner.

In order to describe the embodiment more conveniently, a three-dimensional coordinate system is provided in the figures, wherein the X axis indicates a widthwise direction of the housing **20**, the Y axis indicates a lengthwise direction of the housing **20**, and the Z axis indicates a height direction of the housing **20**. The substrate **31** of the light source **30** is arranged in the housing **20** on a plane defined by the X axis and the Y axis.

Referring to FIGS. **3-5**, each LED unit **33** includes an LED **32** mounted on the substrate **31** and a lens **50** coupled to the LED **32**. The LED **32** includes an LED die **321** which can emit light. The LED die **321** may be a GaN die, a ZnS die, a ZnSe die or other type dies which could emit light with a desirable color. The lens **50** covers on the LED **32** and is fixed to the substrate **31**. The substrate **31** may be a metal core printed circuit board (MCPCB), a ceramic printed circuit board (CPCB) or other suitable circuit boards having good heat-conducting capabilities.

The lens **50** is made of transparent materials such as PC (polycarbonate) or PMMA (polymethylmethacrylate). The lens **50** includes a flat bottom surface **501** and an outer surface **502** around the lens **50**. In this embodiment, the lens **50** is formed by cutting through a bottom portion of an ellipsoid. Thus, the bottom surface **501** has the shape of an ellipse, and the outer surface **502** of the lens **50** has the shape of an ellipsoid. The bottom surface **501** has a center O at which the LED die **321** is located. The ellipsoid forming the lens **50** has a geometrical center o, wherein the center O of the bottom surface **501** is located below the center o of the ellipsoid. Thus, the lens **50** is in the form of an elongated, truncated ellipsoid.

The lens **50** is mounted on the LED **32** with a major axis of the bottom surface **501** being coincident with the Y axis and a minor axis of the bottom surface **501** being coincident with the X axis. A half length G of the major axis of the bottom surface **501** is longer than a half length F of the minor axis. The lens **50** has a height H along the Z axis. The lens **50** has an area on the plane defined by the X axis and the Y axis, and located above the center O which is gradually decreased from bottom to top along the Z axis.

A rectangular receiving groove **503** is defined in the bottom surface **501** of the lens **50** for receiving the LED **32** therein. A central portion of the receiving groove **503** is further recessed towards the lens **50** to form a spherical cavity **504**. The cavity **504** is located above the receiving groove **503** and communicates with the receiving groove **503**. An inner surface of the cavity **504** forms as a spherical light-incident surface **505** through which the light emitting from the LED **32** enters the lens **50**. The LED **32** is spaced from the light-incident surface **505** by an air gap. A round bottom edge of the light-incident surface **505** connects with two opposite edges of the receiving groove **503** along the Y axis, and spaces from another two opposite edges of the receiving groove **503** along the X axis. A radius of a sphere forming the cavity **504** is greater than a distance between the LED die **321** and one of the edges of the receiving groove **503** along the Y axis. A pair of cutouts **506** are defined in two opposite sides of the lens **50** along the Y axis. Each of the cutouts **506** extends through the bottom surface **501** of the lens **50** to receive glue (not shown) therein to adhesively attach the lens **50** on the substrate **31**.

The outer surface **502** of the lens **50** forms as a curved light-emergent surface of the lens **50** through which the light within the lens **50** is refracted out of the lens **50**. Referring to FIG. **4**, a first light ray L**1** emitting from the LED **32** and projecting on a particular point of the outer surface **502** with an incident angle α is refracted out of the lens **50** with an emergent angle β**1** which is greater than the incident angle α, whereby the light projecting on the outer surface **502** along the X axis is upwardly converged by the lens **50**. Referring to FIG. **5**, a second light ray L**2** emitting from the LED **32** and projecting on another particular point of the outer surface **502** with an incident angle α is refracted out of the lens **50** with an emergent angle β**2** which is greater than the incident angle α, whereby the light projecting on the outer surface **502** along the Y axis is upwardly converged by the lens **50**.

Since the lens **50** has the shape like an ellipsoid, the lens **50** has two opposite sides along the Y axis longer than the other two opposite sides along the X axis, such that a curvature of the outer surface **502** along the X axis is greater than a curvature of the outer surface **502** along the Y axis. The light projecting on the outer surface **502** along the X axis is upwardly converged in a narrower manner than the light projecting on the outer surface **502** along the Y axis. As a result, the emergent angle β**1** is greater than the emergent angle β**2**.

The housing **20** has a length along the Y axis much greater than a width along the X axis. Due to the presence of the lens **50**, the light from the LEDs **32** can enter the light distribution space **24** of the housing **20** effectively and uniformly. Particularly, the light refracted out from the lens **50** along the X axis is converged within a relatively narrower region than the light refracted out from the lens **50** along the Y axis in response to the fact that the housing **20** has a length along the Y axis much greater than a width along the X axis. The light from all of the LEDs **32** is radiated into and mixed in the light distribution space **24** of the housing **20**, and then the light is projected on the sign **221** to cause the sign **221** to be illuminated. Thus, the light-utilizing efficiency of the light source **30** is accordingly increased.

FIGS. **6-8** show a lens **51** according to a second embodiment. The lens **51** is different from the lens **50** in the following aspects.

The center O of a bottom surface **511** of the lens **51** is located above the center o of the ellipsoid forming lens **51**, such that the lens **51** is formed as a shortened, truncated ellipsoid. An inner surface of a cavity **514** of the lens **51** forms as a spherical or ellipsoidal light-incident surface **515** through which the light emitting from the LED **32** enters the lens **51**. A round bottom edge of the light-incident surface **515** connects with the four edges of the receiving groove **503**, such that the light has less interference between the light-incident surface **515** and the edges of the receiving groove **503**. In this embodiment, the light-incident surface **515** is ellipsoidal with a major axis thereof being coincident with the X axis and a minor axis thereof being coincident with the Y axis.

Two opposite side portions of the lens **51** along the X axis are cut away from the lens **51** to form two cutting surfaces **517**. Each cutting surface **517** forms an acute angle γ with respect to the bottom surface **511**, in order to ensure that the light projecting on the cutting surfaces **517** defines a light-incident angle θ greater than a critical angle θc to take place

a total reflection on the cutting surfaces **517**. The critical angle θc can be calculated by a formula: θc=arcSin(n**2**/n**1**), wherein n**1** is an refractive index of the lens **51**, and n**2** is an refractive index of atmosphere. The greater the refractive index of the material made of the lens **51** is, the smaller the critical angle θc will be. For example, the refractive index n**1** of the lens **51** made from PMMA is 1.49, and the critical angle θc is 42°; the refractive index n**1** of the lens **51** made from PC is 1.59, and the critical angle θc is 39°; the refractive index n**1** of the lens **51** made from diamond is 2.24, and the critical angle θc is 26.5°. The emergent light from a vertex **518** of the cutting surfaces **517** just projects on a bottom side **212** (shown in FIG. **1**) of the front panel **22**. The light projecting on the cutting surfaces **517** below the vertex **518** is totally reflected back into the lens **51** by the cutting surfaces **517**, then projects on the outer light-emergent surface **512** and is refracted out of the lens **51** from the light-emergent surface **512**, such that the light of the LED **32** is effectively utilized.

The angle γ of each cutting surface **517** is related to the material made of the lens **51** and an angle Φ between the light entering the lens **51** from the light-incident surface **515** and the Z axis. In particular, the relation of γ<(90−Φ)+(90−θc) is established, whereby all of the light projecting on the cutting surfaces **517** are totally reflected back into the lens **51**. For example, the angle Φ is 60° or 90°, and the lens **51** is made of PMMA, thus, the angle γ is smaller than 78° or 48°. If the angle Φ is fixed, the greater the refractive index of the material made of the lens **51**, the larger the angle γ will be. Preferably, the angle γ is kept within a range of 30° to 75°. In addition, a light reflecting material may be coated on each cutting surface **517** in case a cutting angle beyond the range of the angle γ to increase the light reflective effect.

Referring to FIG. **7**, a third light ray L**3** emitting from the LED **32** and projecting on a particular point of the outer surface **512** with an incident angle α is refracted out of the lens **51** with an emergent angle β**3** which is greater than the incident angle α, whereby the light projecting on the outer surface **512** along the X axis is upwardly converged by the lens **51**. Referring to FIG. **8**, a fourth light ray L**4** emitting from the LED **32** and projecting on another particular point of the outer surface **512** with an incident angle α is refracted out of the lens **51** with an emergent angle β**4** which is greater than the incident angle α, whereby the light projecting on the outer surface **512** along the Y axis is upwardly converged by the lens **51**. Similarly, the emergent angle β**3** is greater than the emergent angle β**4**.

FIG. **9** shows a lens **52** according to a third embodiment. The lens **52** is integrally formed with a first lens portion **528** and a second lens portion **529** coupled on the first lens portion **528** along the Z axis thereof. The first lens portion **528** is formed by cutting through a bottom portion of a sphere or an ellipsoid with larger size along a plane defined by the X axis and the Y axis. The second lens portion **529** is formed by cutting through a bottom portion of a sphere or an ellipsoid with smaller size. The first and second lens portions **528**, **529** cooperatively form an edge surface **520** at a joint therebetween. In other words, a light-emergent surface of the lens **52** can be derived from the lens **50** of the first embodiment, such that the lens **52** forms the shape of an elongated, truncated sphere or ellipsoid, wherein a center O of a bottom surface **521** of the lens **52** is located below a geometrical center o of the sphere or ellipsoid. Two opposite side portions of the first lens portion **528** along the X axis are cut away to form two cutting surfaces **527** similar to the second embodiment. A rectangular receiving groove **523** is defined in the bottom surface **521** of the lens **52** for receiving the LED **32** therein. The light projecting on the cutting surfaces **527** of the first lens portion **528** is totally reflected by the cutting surfaces **527** into the first lens portion **528** and then is refracted out of the lens **52** from the second lens portion **529** above the first lens portion **528**.

FIG. **10** shows a lens **53** according to a fourth embodiment. The lens **53** is integrally formed with a first lens portion **536** and a second lens portion **537** intersecting the first lens portion **536** along the Z axis thereof. The first lens portion **536** and the second lens portion **537** have a same height along the Z axis. The first lens portion **536** is formed by cutting through a bottom portion of an ellipsoid with smaller size along a plane defined by the X axis and the Y axis, and is positioned at two opposite sides of the lens **53** along the X axis. The second lens portion **537** is formed by cutting through a bottom portion of a sphere with larger size, and is positioned at two opposite sides of the lens **53** along the Y axis. The first lens portion **536** has a flat elliptic bottom surface **5361** on the plane defined by the X axis and the Y axis. The second lens portion **537** has a flat circular bottom surface **5371** on the plane defined by the X axis and the Y axis and coplanar with the bottom surface **5361** of the first lens portion **536**. A major axis of the bottom surface **5361** of the first lens portion **536** is on the Y axis, and a minor axis of the bottom surface **5361** of the first lens portion **536** is on the X axis. The major axis of the bottom surface **5361** of the first lens portion **536** is longer than a diameter of the bottom surface **5371** of the second lens portion **537**. The minor axis of the bottom surface **5361** of the first lens portion **536** is shorter than the diameter of the bottom surface **5371** of the second lens portion **537**.

A light-emergent surface **532** of the lens **53** includes a portion of ellipsoidal surface **538** at the two opposite sides of the lens **53** along the X axis, a portion of spherical surface **539** at the two opposite sides of the lens **53** along the Y axis, and four edge surfaces **530** interconnecting the portion of ellipsoidal surface **538** and the portion spherical surface **539**. The portion of spherical surface **539** exceeds the portion of ellipsoidal surface **538** along the Y axis. The lens **53** can be derived from the lens **51** of the second embodiment. A center O of the bottom surface **531** of the lens **53** is located above a geometrical center o of the ellipsoid forming the first lens portion **536**, such that the lens **53** is formed as a shortened, truncated ellipsoid.

In the emergency exit indicator, each LED **32** is coupled with a lens **50** (**51**, **52**, **53**). The light from the LED **32** is converged in each of the X axis and the Y axis, and the light in the X axis is converged narrower than in the Y axis, such that the light from all of the LEDs **32** can effectively enter and be mixed uniformly in the light distribution space **24**, whereby the light can illuminate on the sign **221** uniformly from the light distribution space **24**. In the aforementioned embodiments, the ratio of H/F is between 1 and 10, and the relation of 1<H/G<H/F is established, such that the sign **221** on the front panel **22** of the housing **20** is uniformly illuminated by the light of the LEDs **32**.

It is believed that the disclosure and its advantages will be understood from the foregoing description, and it will be apparent that various changes may be made thereto without departing from the spirit and scope of the disclosure or sacrificing all of its material advantages, the examples hereinbefore described merely being preferred or exemplary embodiments.

What is claimed is:

1. An emergency exit indicator, comprising:

a flat housing having a length greater than a width thereof, the housing comprising a panel, a sign provided on the panel to mark emergency exits; and

a light source received in the housing, the light source comprising a plurality of LEDs and a corresponding number of lenses each coupled to a corresponding LED, light of the LED going through the lens and then being illuminated on the sign to cause the sign to be visible, the lens comprising two opposite sides along a lengthwise direction of the housing longer than other two opposite sides along a widthwise direction of the housing, the light through the lens along the widthwise direction of the housing converged in a narrower manner than the light through the lens along the lengthwise direction of the housing.

2. The emergency exit indicator of claim **1**, wherein the lens is formed by cutting through a bottom portion of an ellipsoid such that the lens comprises a flat bottom surface and an outer surface around the lens, the light of the LED being refracted out of the lens through the outer surface, the bottom surface having the shape of an ellipse, the outer surface of the lens having the shape of an ellipsoid, the LED being received in the flat bottom surface.

3. The emergency exit indicator of claim **2**, wherein the bottom surface has a center O, the ellipsoid forming the lens having a geometrical center o, the center O of the bottom surface being located below the center o of the ellipsoid such that the lens is in the form of an elongated, truncated ellipsoid.

4. The emergency exit indicator of claim **2**, wherein the bottom surface has a center O, the ellipsoid forming the lens having a geometrical center o, the center O of the bottom surface being located above the center o of the ellipsoid such that the lens is in the form of a shortened, truncated ellipsoid.

5. The emergency exit indicator of claim **2**, wherein the bottom surface comprises a major axis along the lengthwise direction of the housing, and a minor axis along the widthwise direction of the housing, a half of a length of the major axis being G, a half of a length of the minor axis being F, the lens having a height H along a height direction of the housing, the value of H/F being located between 1 and 10, the relation of $1<H/G<H/F$ being established.

6. The emergency exit indicator of claim **2**, wherein a rectangular receiving groove is defined in the bottom surface of the lens for receiving the LED therein, a central portion of the receiving groove being further recessed towards the lens to form a cavity, an inner surface of the cavity forming as a light-incident surface through which the light emitting from the LED enters the lens.

7. The emergency exit indicator of claim **6**, wherein a bottom edge of the light-incident surface connects with two opposite edges of the receiving groove along the lengthwise direction of the housing, and spaces from another two opposite edges of the receiving groove along the widthwise direction of the housing.

8. The emergency exit indicator of claim **6**, wherein a bottom edge of the light-incident surface connects with four edges of the receiving groove.

9. The emergency exit indicator of claim **6**, wherein the light-incident surface is ellipsoidal with a major axis thereof being coincident with the widthwise direction of the housing and a minor axis thereof being coincident with the lengthwise direction of the housing.

10. The emergency exit indicator of claim **1**, wherein the lens is integrally formed with a first lens portion and a second lens portion coupled on the first lens portion along a height direction of the housing, the first and second lens portions cooperatively forming an edge surface at a joint therebetween.

11. The emergency exit indicator of claim **10**, wherein the first lens portion is formed by cutting through a bottom portion of a sphere or an ellipsoid with larger size, the second lens portion being formed by cutting through a bottom portion of a sphere or an ellipsoid with smaller size.

12. The emergency exit indicator of claim **1**, wherein the lens is integrally formed with a first lens portion and a second lens portion intersecting the first lens portion along a height direction of the housing, the first and second lens portions having a same height along a height direction of the housing and a mutual bottom surface, a light-emergent surface of the lens comprising a portion of ellipsoidal surface at two opposite sides of the lens along the widthwise direction of the housing and a portion of spherical surface at two opposite sides of the lens along the lengthwise direction of the housing, and four edge surfaces interconnecting the portion of ellipsoidal surface and the portion spherical surface, the portion of spherical surface exceeding the portion of ellipsoidal surface along the lengthwise direction of the housing.

13. The emergency exit indicator of claim **12**, wherein the first lens portion is formed by cutting through a bottom portion of an ellipsoid with smaller size, the second lens portion being formed by cutting through a bottom portion of a sphere with larger size, a bottom surface of the first lens portion being coplanar with a bottom surface of the second lens portion, a major axis of the bottom surface of the first lens portion being located along the lengthwise direction of the housing, a minor axis of the bottom surface of the first lens portion being located along the widthwise direction of the housing, the major axis of the bottom surface of the first lens portion being longer than a diameter of the bottom surface of the second lens portion, the minor axis of the bottom surface of the first lens portion being shorter than the diameter of the bottom surface of the second lens portion.

14. The emergency exit indicator of claim **1**, wherein two opposite side portions of the lens along the widthwise direction of the housing are cut away from the lens to form two cutting surfaces, the light emitting from the LED and projecting on the cutting surfaces being totally reflected back into the lens by the cutting surface.

15. The emergency exit indicator of claim **14**, wherein each of the cutting surfaces forms an angle γ with respect to a bottom surface of the lens, an angle Φ being defined between a height direction of the housing and the light entering the lens from a light-incident surface of the lens, the lens having a critical angle θc, the relation of $\gamma<(90-\Phi)+(90-\theta c)$ being established.

16. The emergency exit indicator of claim **15**, wherein the angle γ is kept within a range of 30° to 75°.

17. The emergency exit indicator of claim **1**, further comprising an electrical module received in the housing, the electric module comprising a circuit board and a rechargeable battery electrically connected with the circuit board, when an electrical power is supplied normally to the light source, the light source emits light and the rechargeable battery is charged, and when the electrical power is interrupted, the rechargeable battery supplies power to the light source.

18. The emergency exit indicator of claim **1**, wherein the light source is located at a bottom side in the housing, a light distribution space bring defined in the housing above the light source, the light from the LEDs of the light source entering and being mixed in the light distribution space before the light illuminates on the sign.

19. The emergency exit indicator of claim **17**, wherein the light source further comprises a substrate arranged along the lengthwise direction of the housing, the LEDs being evenly spaced from each other on the substrate.

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